DATA SHEET

BLV193
UHF power transistor

Product specification

March 1993

Philips
Semiconductors

PHILIPS

UHF power transistor BLV193

FEATURES

- Emitter ballasting resistors for an optimum temperature profile
- Gold metallization ensures excellent reliability.

DESCRIPTION

NPN silicon planar epitaxial transistor intended for common emitter class-A and class-AB operation in the 900 MHz communications band.

The transistor has a SOT171 flange envelope with a ceramic cap. All leads are isolated from the mounting base.

PINNING - SOT171

PIN	DESCRIPTION
1	emitter
2	emitter
3	base
4	collector
5	emitter
6	emitter

QUICK REFERENCE DATA

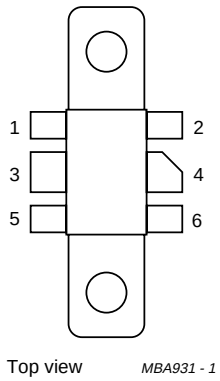
RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)	d_{im} (dB) (note 1)
c.w. class-AB	900	12.5	12	≥ 6.5	≥ 50	–
c.w. class-A	900	12	6 (PEP)	typ. 11	–	typ. –30

Note

1. 2-tone measurement, f_p = 900 MHz, f_q = 901 MHz.

PIN CONFIGURATION



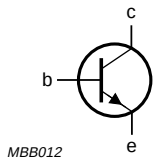


Fig.1 Simplified outline and symbol.

WARNING

Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	36	V
V_{CEO}	collector-emitter voltage	open base	–	16	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current	DC or average value	–	3.5	A
P_{tot}	total power dissipation	up to T_{mb} = 25 °C	–	44	W
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	200	°C

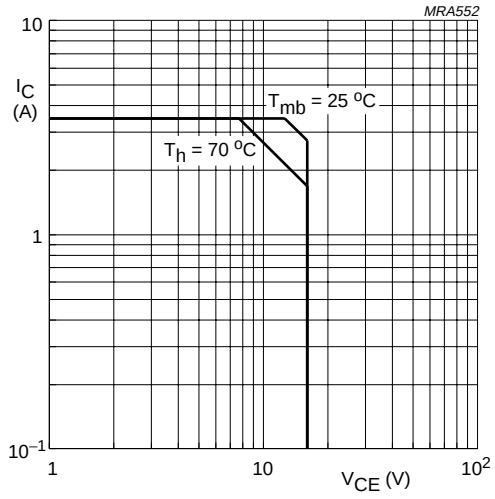
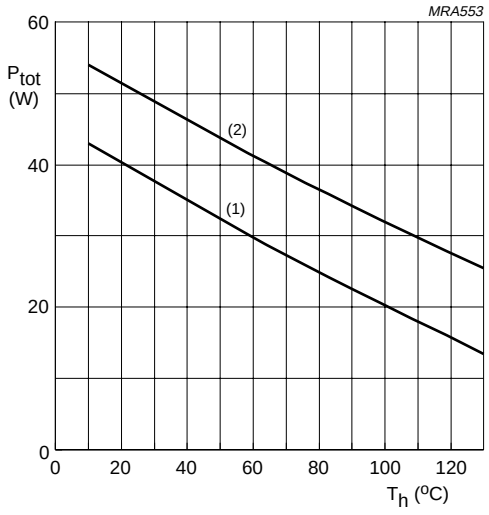


Fig.2 DC SOAR.



(1) Continuous operation.
(2) Short time operation during mismatch.

Fig.3 Power derating curves.

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	from junction to mounting base	P_{dis} = 44 W; T_{mb} = 25 °C	4.0 K/W
$R_{th\ mb\text{-}h}$	from mounting base to heatsink		0.4 K/W

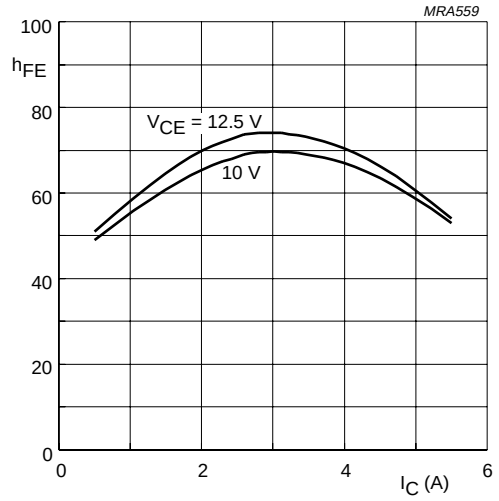
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_c = 20 mA	36	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_c = 40 mA	16	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 0.5 mA	3	–	–	V
I_{CES}	collector-emitter leakage current	V_{CE} = 16 V; V_{BE} = 0	–	–	1	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_c = 1.2 A; note 1	25	60	–	
C_c	collector capacitance	V_{CB} = 12.5 V; $I_E = I_e$ = 0; f = 1 MHz	–	24.5	–	pF
C_{re}	feedback capacitance	V_{CE} = 12.5 V; I_c = 0; f = 1 MHz	–	13	–	pF
$C_{c\text{-}mb}$	collector-mounting base capacitance		–	2	–	pF

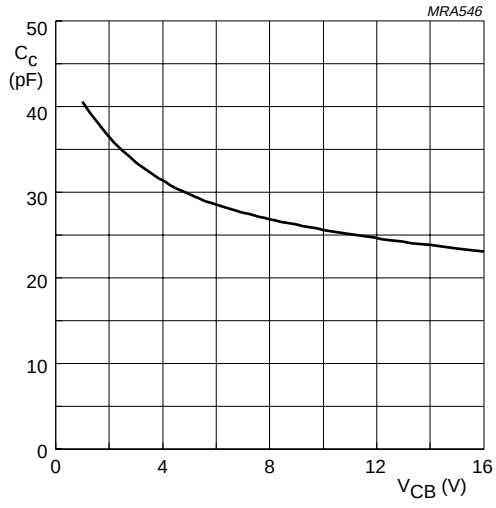
Note

1. Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0.02$.



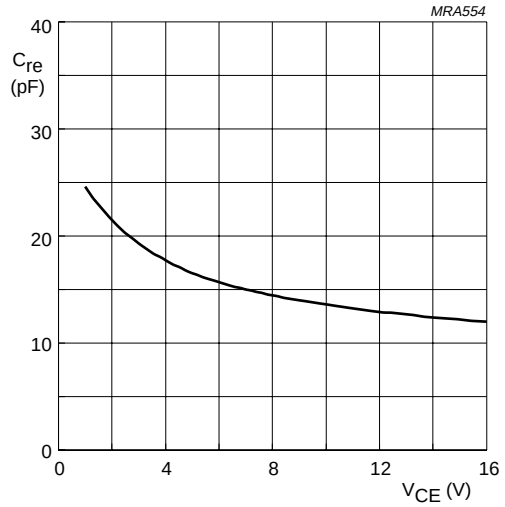
Measured under pulse conditions: $t_p \leq 200\ \mu s$; $\delta \leq 0.02$.

Fig.4 DC current gain as a function of collector current, typical values.



$I_E = i_e = 0$; f = 1 MHz.

Fig.5 Collector capacitance as a function of collector-base voltage, typical values.



f = 1 MHz.

Fig.6 Feedback capacitance as a function of collector-emitter voltage, typical values.

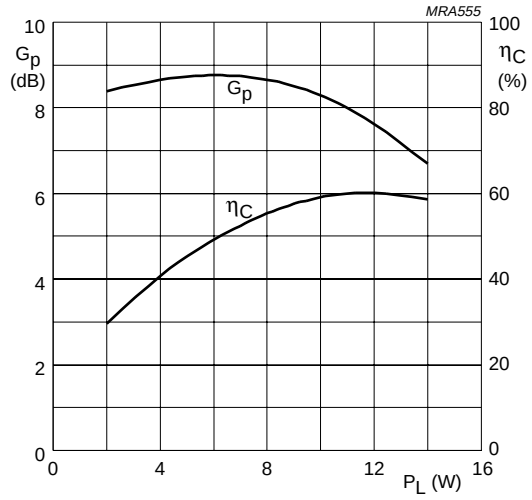
APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter test circuit; $R_{th\ j\text{-}mb}$ = 0.4 K/W.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (A)	P_L (W)	G_P (dB)	η_c (%)	d_{im} (dB) (note 1)
c.w. class-AB	900	12.5	0.01	12	≥ 6.5 typ. 7.5	> 50 typ. 60	–
c.w. class-A	900	12	1.3	6 (PEP)	typ. 11	–	typ. –30

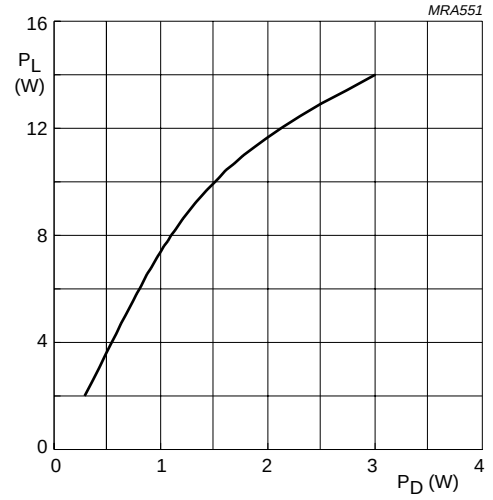
Note

1. 2-tone measurement, f_p = 900 MHz, f_q = 901 MHz.



Class-AB operation; V_{CE} = 12.5 V; f = 900 MHz; I_{CQ} = 10 mA.

Fig.7 Gain and efficiency as functions of load power, typical values.



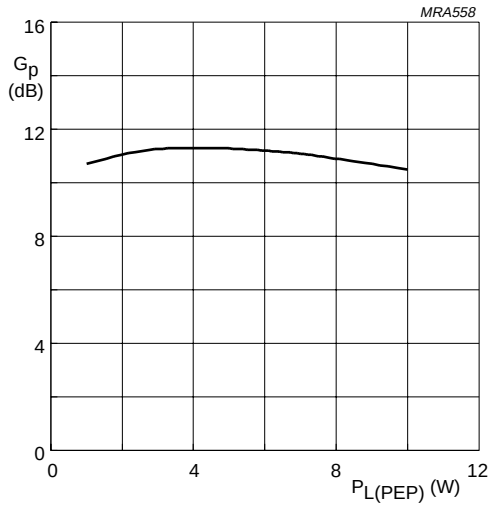
Class-AB operation; V_{CE} = 12.5 V; f = 900 MHz; I_{CQ} = 10 mA.

Fig.8 Load power as a function of drive power, typical values.

Ruggedness in class-AB operation

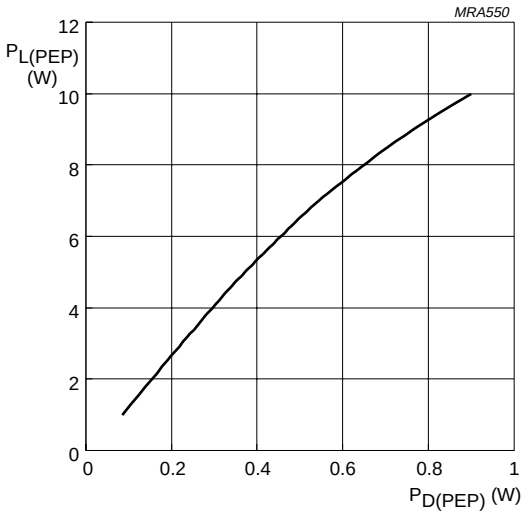
The BLV193 is capable of withstanding a load mismatch corresponding to VSWR = 10:1 through all phases under the following conditions:

V_{CE} = 15.5 V, f = 900 MHz,
T_h = 25 °C, $R_{th\ j\text{-}mb}$ = 0.4 K/W, and
rated output power.



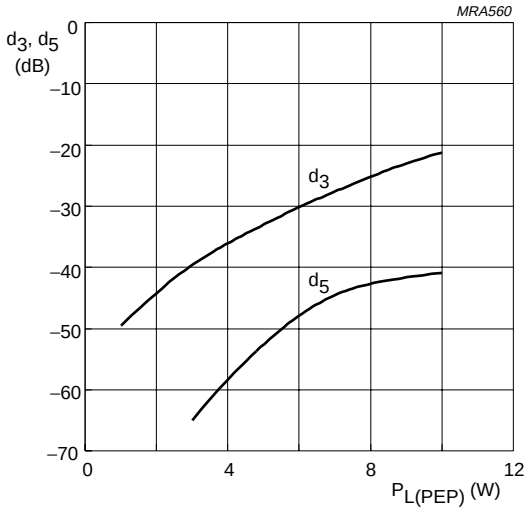
Class-A operation; V_{CE} = 12 V; I_C = 1.3 A;
f_p = 900 MHz; f_q = 901 MHz.

Fig.9 Gain as a function of load power (PEP), typical values.



Class-A operation; V_{CE} = 12 V; I_C = 1.3 A;
f_p = 900 MHz; f_q = 901 MHz.

Fig.10 Load power (PEP) as a function of drive power (PEP), typical values.



Class-A operation; V_{CE} = 12 V; I_C = 1.3 A;
f_p = 900 MHz; f_q = 901 MHz.

Fig.11 Intermodulation products as a function of load power (PEP), typical values.

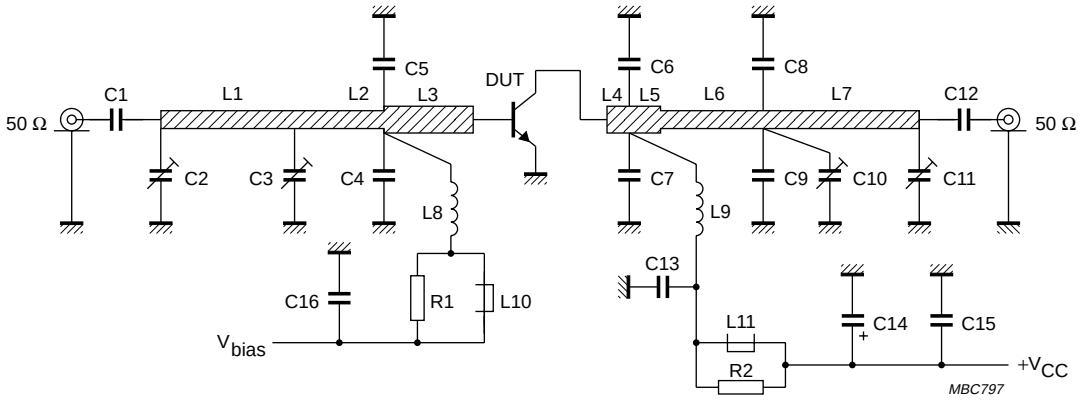


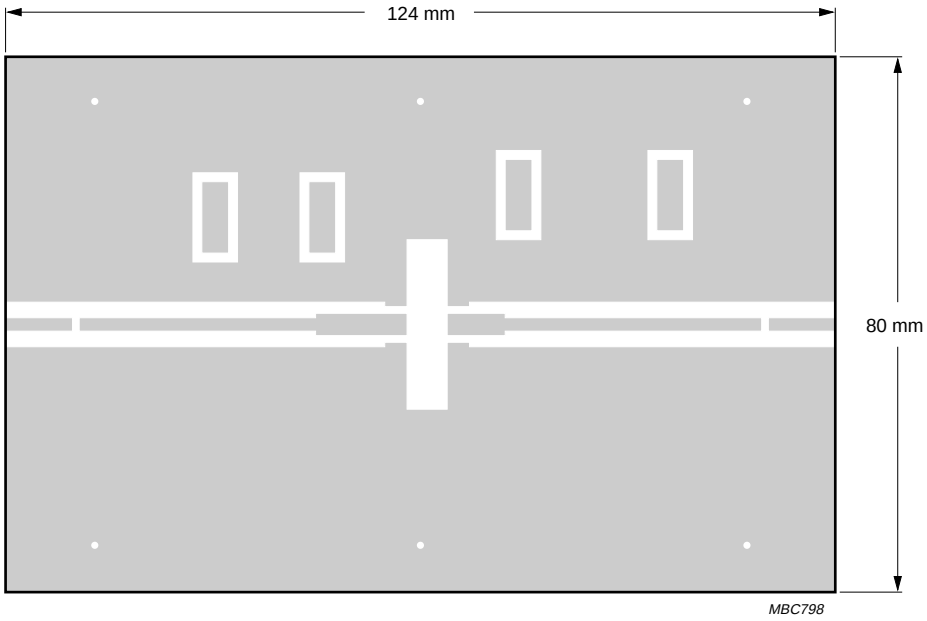
Fig.12 Class-A and class-AB test circuit at f = 900 MHz.

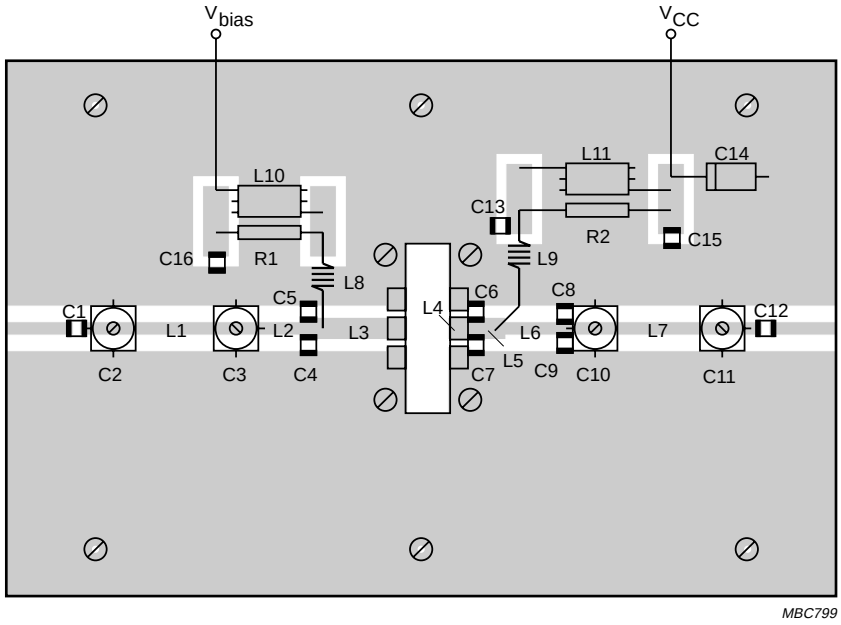
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C12	multilayer ceramic chip capacitor (note 1)	33 pF		
C2, C3, C10, C11	film dielectric trimmer	1.4 to 5.5 pF		2222 809 09001
C4, C5	multilayer ceramic chip capacitor (note 1)	4.7 pF		
C6, C7	multilayer ceramic chip capacitor (note 1)	5.6 pF		
C8, C9	multilayer ceramic chip capacitor (note 1)	3.3 pF		
C13	multilayer ceramic chip capacitor (note 1)	10 pF		
C14	electrolytic capacitor	6.8 μF, 63 V		
C15	multilayer ceramic chip capacitor (note 1)	330 pF		
C16	multilayer ceramic chip capacitor	100 nF		2222 852 47104
L1, L7	stripline (note 2)	50 Ω	length 29 mm; width 2.4 mm	
L2	stripline (note 2)	50 Ω	length 6 mm; width 2.4 mm	
L3	stripline (note 2)	42.7 Ω	length 13.1 mm; width 3 mm	
L4	stripline (note 2)	42.7 Ω	length 4.4 mm; width 3 mm	
L5	stripline (note 2)	42.7 Ω	length 4.6 mm; width 3 mm	
L6	stripline (note 2)	50 Ω	length 7 mm; width 2.4 mm	
L8	4 turns closely wound enamelled 0.4 mm copper wire	60 nH	int. dia 3 mm; leads 2 × 5 mm	
L9	4 turns enamelled 1 mm copper wire	45 nH	int. dia. 4 mm; leads 2 × 5 mm	
L10, L11	grade 3B Ferroxcube wideband HF choke			4312 020 36642
R1, R2	metal film resistor	10 Ω, 0.25 W		

Notes

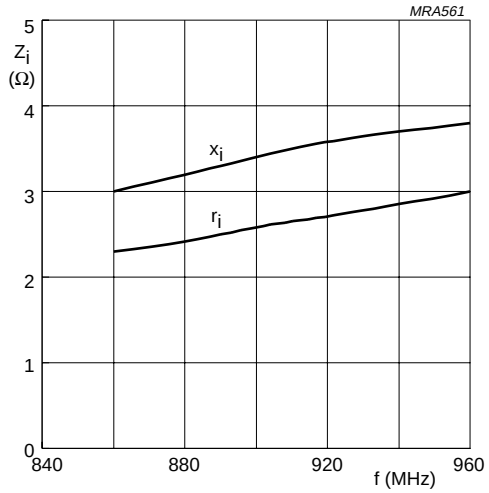
1. American Technical Ceramics type 100A or capacitor of the same quality.
2. The striplines are on a double copper-clad printed circuit board, with PTFE fibre-glass dielectric (ε_r = 2.2), thickness $^1/_{32}$ inch.





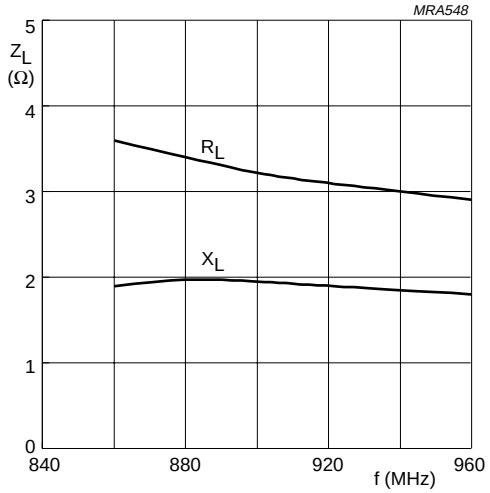
The components are mounted on one side of a copper clad PTFE fibre-glass board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by fixing screws and copper straps under the emitter leads.

Fig.13 Printed circuit board and component layout for 900 MHz test circuit.



Class-AB operation; V_{CE} = 12.5 V; I_{CQ} = 10 mA;
P_L = 12 W; T_h = 25 °C.

Fig.14 Input impedance (series components) as a function of frequency, typical values.



Class-AB operation; V_{CE} = 12.5 V; I_{CQ} = 10 mA;
P_L = 12 W; T_h = 25 °C.

Fig.15 Load impedance (series components) as a function of frequency, typical values.

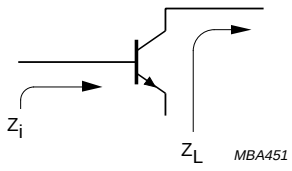
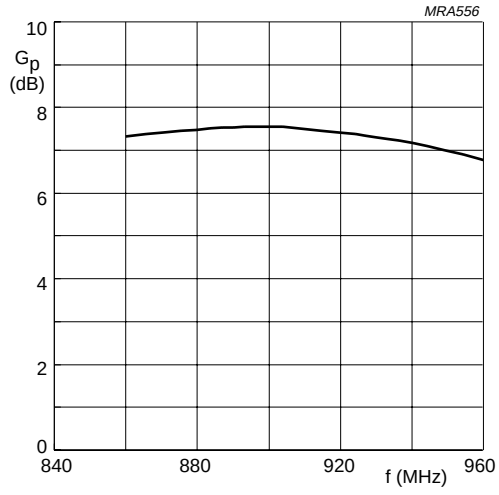
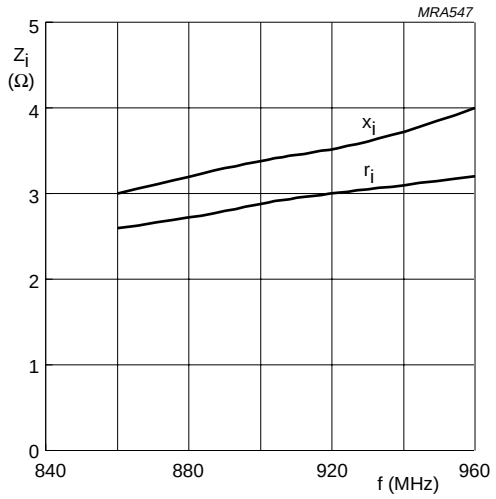


Fig.16 Definition of transistor impedance.



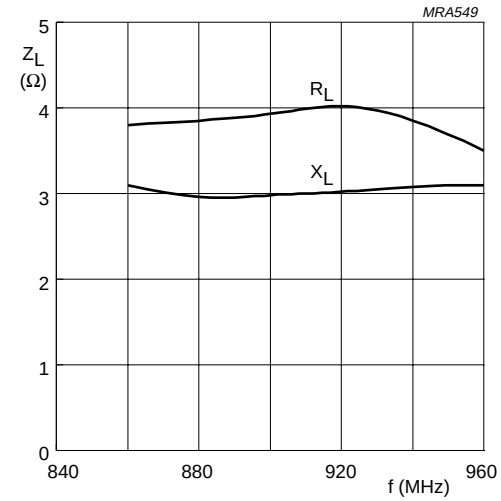
Class-AB operation; V_{CE} = 12.5 V; I_{CQ} = 10 mA;
P_L = 12 W; T_h = 25 °C.

Fig.17 Power gain as a function of frequency, typical values.



Class-A operation; V_{CE} = 12 V; I_C = 1.3 A;
T_h = 25 °C.

Fig.18 Input impedance (series components) as a function of frequency, typical values.



Class-A operation; V_{CE} = 12 V; I_C = 1.3 A;
T_h = 25 °C.

Fig.19 Load impedance (series components) as a function of frequency, typical values.

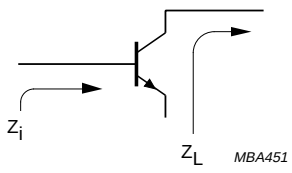
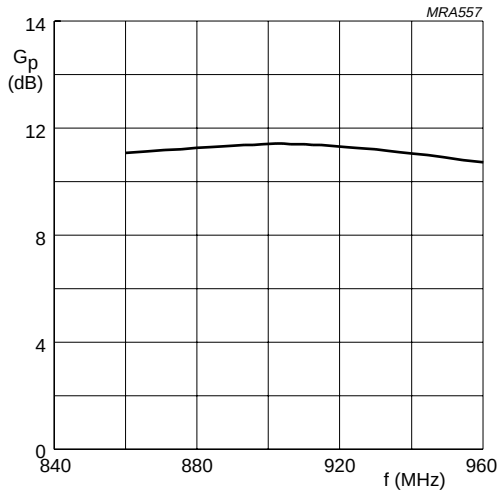


Fig.20 Definition of transistor impedance.

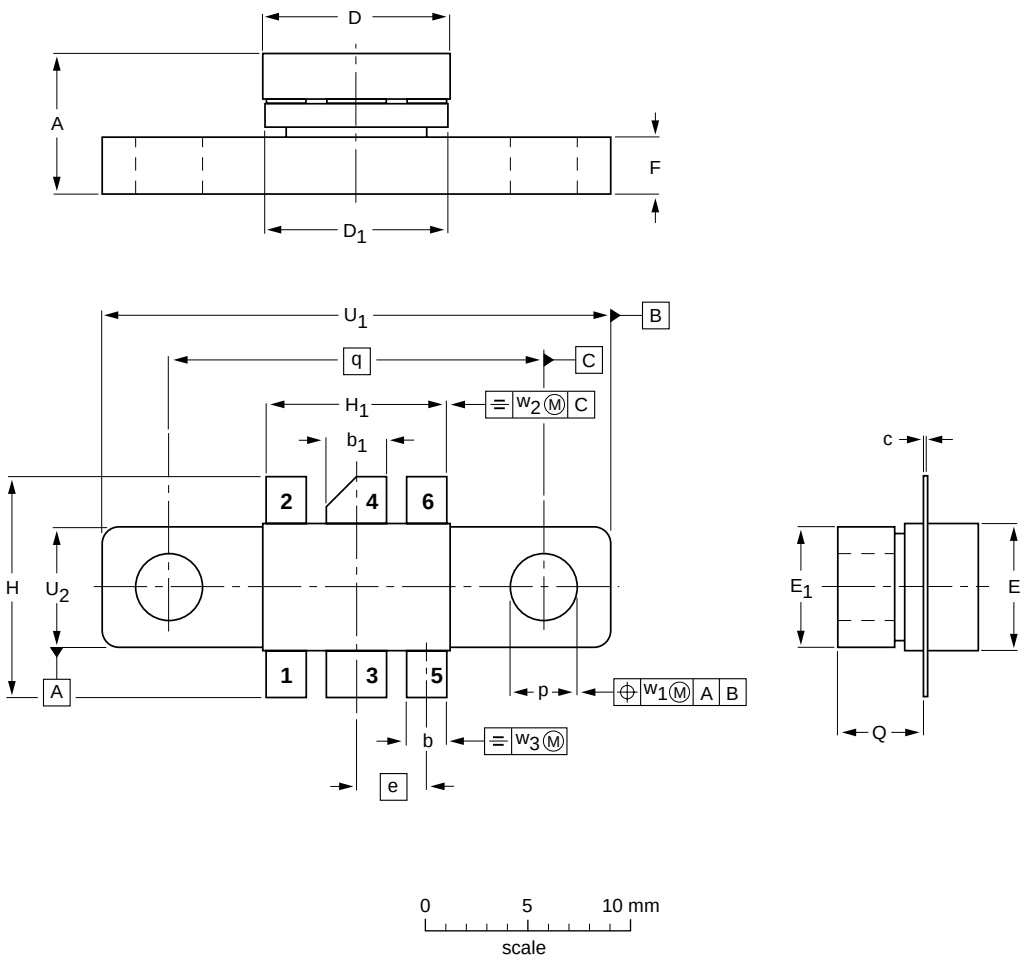


Class-A operation; V_{CE} = 12 V; I_C = 1.3 A;
T_h = 25 °C.

Fig.21 Power gain as a function of frequency, typical values.

PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 6 leads **SOT171A**



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	b_1	c	D	D_1	E	E_1	e	F	H	H_1	p	Q	q	U_1	U_2	w_1	w_2	w_3
mm	6.81 6.07	2.15 1.85	3.20 2.89	0.16 0.07	9.25 9.04	9.30 8.99	5.95 5.74	6.00 5.70	3.58	3.05 2.54	11.31 10.54	9.27 9.01	3.43 3.17	4.32 4.11	18.42	24.90 24.63	6.00 5.70	0.51	1.02	0.26
inches	0.268 0.239	0.085 0.073	0.126 0.114	0.006 0.003	0.364 0.356	0.366 0.354	0.234 0.226	0.236 0.224	0.140	0.120 0.100	0.445 0.415	0.365 0.355	0.135 0.125	0.170 0.162	0.725	0.980 0.970	0.236 0.224	0.02	0.04	0.01

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT171A						97-06-28

DEFINITIONS

Data Sheet Status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

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